Review Comments on
Keck et al.; Quantitative imaging of 3-D distribution of cation adsorption sites in undisturbed soil.

This manuscript used X-ray tomographic contrast imaging to determine the spatial heterogeneity of cation adsorption sites (CAS) with 80-micron spatial resolution. The authors showed remarkable consistency of barium distributions in samples from a silty agricultural soil compared with samples from more organic-matter rich, more clayey forest and bog soils.

Specific comments

1. p. 5, L. 19-23 and p. 6, L. 22-23: How much of the Ba2+ is likely removed from the CAS with a 0.1 M KCl wash? Although there should be a high proportion of divalent to monovalent cation in the exchanger phase for an equal ratio of aqueous cations, it seems that a 0.1 M KCl wash would remove a significant portion of Ba2+ from the CAS? Perhaps the assumption that all CAS was saturated with Ba2+ after the 0.1 M KCl wash (p. 6, L. 22-23) is not completely valid. An alternative is to call the Ba2+-saturated sites "sites of higher affinity for Ba2+"). Actually, the authors address this possibility in their discussion of CEC relationships (p. 10), but perhaps the possibility could be raised in the methods section also.

2. Fig. 5. Is there a "cutoff" difference value to assess what regions of the X-ray images are artifacts? For example, it is not clear in Fig. 5 how it was deduced that the SNO3 sample had a global shift, whereas the "very bright" or "very dark" areas in the SNO2 image was apparent. Also, can a brightness scale bar be put on Fig. 5 (and 6) to give an idea of the difference scale of the various grey shades?

3. It would be helpful to have more details in the methods on how the artificial sample (SNO9) was prepared.

4. Because the manuscript primarily discusses a new X-ray imaging technique, the conclusions could be expanded to present opportunities for using this technique other than for CAS mapping. For example, I found the discussion of organic-lined biopores to be an interesting observation. Could, for example, the technique presented here be used to study such pores in more detail, e.g., at the original spatial resolution of the data for smaller sample volumes?